Structure of Glassy Silica Assessing the Role of the Synthesis Method

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Glassy materials can be synthesized through several techniques, including melt-quenching, sol-gel, and vapor deposition. Although all these techniques yield a disordered atomic network, it remains unclear to what extent the final structure of the glass depends on the synthesis method. This problem is significant as, for a given glass composition, different structures can yield different engineering properties. Here, based on reactive molecular dynamics simulations, we investigate the structure of three silica glass models generated by melt-quenching, sol-gel, and vapor deposition. The structural properties (e.g., density, bond distances, bond angles, and ring size distributions) of the three glass models are thoroughly analyzed and compared. Based on these results, we reveal how the synthesis method controls the stability of glasses.